WORKSHOP ON ADVANCED TECHNIQUES FOR THE ANALYSIS OF TRACE EMERGING CONTAMINANTS IN ENVIRONMENTAL SAMPLES

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FRESHWATER ENVIRONMENTS are widely impacted by a vast number of emerging contaminants such as pharmaceuticals and endocrine disrupting compounds. Information on their fate in aquatic ecosystems, such as adsorption on surfaces, transformation pathways, bioaccumulation in biota, biomagnification in food webs, etc. is still scarce. One of the key steps in improving the overall knowledge on emerging contaminants' fate in aquatic ecosystems is providing efficient information exchange and knowledge transfer on analytical methods needed to analyse environmental samples. The purpose of this workshop is to bring together scientists and environmental practitioners in a dialog about research methodology related to analysis of trace emerging contaminants in environmental samples.

ORGANISERS:

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SPEAKERS

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ICRA PMF UNITYTHROUGH KNOWLEDGEFUND RB SVEUČILIŠTE U ZAGREBU UČITELJSKI FAKULTET

VENUE:
Faculty of Science,
Department of Biology, Rooseveltov trg 6, Zagreb

PROGRAMME:

Time	Topic	Speaker
10:00-10:05	Welcome	
10:05-10:50	Emerging organic contaminants in the aquatic environment. Sources, transport and fate	Prof. Mira Petrović Catalan Institute for Water Research - ICRA
10:50-11:10	Coffee break	
11:10-11:55	Analysis of emerging organic contaminants in water and sediment samples	Dr. Ivan Senta Ruđer Bošković Institute - RBI
11:55-12:40	Bioaccumulation of emerging organic contaminants in aquatic organisms. Chemical analysis.	Dr. Sara Rodriguez-Mozaz Catalan Institute for Water Research - ICRA
12:40-13:00	Coffee break	
13:00-13:45	Target and nontarget data analysis of trace emerging contaminants in environmental samples	Dr. Marko Rožman Ruđer Bošković Institute - RBI
13:45	Wrap up and close	

Emerging organic contaminants in the aquatic environment. Sources, transport and fate.

Prof. Mira Petrović
Catalan Institute for Water Research -ICRA, Girona, Spain,
and Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

Water contamination is one of the major environmental concerns faced by the world today. Water quality has a direct impact on citizens and economic sectors that use and depend on water, such as agriculture, tourism, industry, energy and transport. It also affects river-associated ecosystems and the biodiversity they host. The effects of water contamination on humans are many, including disruption of the natural food chain, diseases as well as serious harm to aquatic ecosystems.

In the European Union, water pollution is regulated under the Water Framework Directive (WFD) (Directive 2000/60/EC), which established a framework for community action in the field of water policy. The most recent European regulation set Environmental Quality Standards (EQS) for 45 priority substances (Directive 2013/39/EU) and established "Watch list" with 10 additional groups of compounds (with 17 substances) of possible concern that require targeted EU-wide monitoring in order to support the prioritization process in future reviews of the priority substance list. However, current use of chemicals by our technological society can be estimated in some hundreds of thousands of compounds (most of them organics) and this number is continuously growing. Depending on their properties and extent of use, a large amount of different chemicals can potentially reach the environment, being their environmental and health effects hard to predict in the long term. Those so-called "emerging" unregulated contaminants have emerged as an environmental problem and there is a widespread consensus that this kind of contamination may require additional legislative intervention.

This presentation will give a short overview of emerging organic contaminants; main sources and processes governing their occurrence in the aquatic environment.

Analysis of emerging organic contaminants in water and sediment samples

Dr. Ivan Senta
Ruđer Bošković Institute - RBI,
Division for Marine and Environmental Research, Zagreb, Croatia

Determination of emerging contaminants in environmental samples is a challenging task, due to the generally very low concentrations of these compounds, which are incorporated in complex environmental matrices. This presentation will provide an overview of analytical methodologies used for determination of emerging organic contaminants in water and sediment samples, with the special emphasis on sample preparation techniques.

Careful optimization of sample preparation is an indispensable step in the trace and ultra-trace analysis of emerging contaminants in complex environmental samples. Sample preparation usually includes the selected extraction technique, which is required for both analyte concentration (to reach low quantification limits) and sample clean-up (to remove matrix interferences). The most important sample preparation strategies will be presented, with special focus on modern and nowadays widely applied techniques, including solid-phase extraction (SPE) for water samples and pressurized liquid extraction (PLE) for solid samples. These methods will be compared with "classical" sample preparation techniques, such as liquid-liquid and Soxhlet extraction.

Moreover, a brief overview of instrumental techniques used for analyte separation and detection will be given as well. The most widely used technique - liquid chromatography coupled to mass spectrometry will be presented in more detail.

Finally, an example of a comprehensive methodology for determination of selected emerging contaminants will be presented.

Bioaccumulation of emerging organic contaminants in aquatic organisms. Chemical analysis.

Dr. Sara Rodriguez-Mozaz
Catalan Institute for Water Research -ICRA, Girona, Spain

The presence of emerging pollutants such as pharmaceuticals (PhACs) in the aquatic environment is well-known but their bioaccumulation in aquatic organisms has only been studied in the last years. Bioaccumulation is therefore, an issue of emerging concern, particularly in those regions affected by water scarcity, where the WWTP effluents (main source of pollution of these pollutants) may represent a high percentage of some streams flow. In this conditions, bioaccumulation of PhACs in aquatic organisms can be favored, having an impact not only in the aquatic organisms but also in humans, who can eventually be exposed to these contaminants through fish ingestion. A crucial step in the impact assessment of pharmaceuticals compounds in aquatic organisms is the establishment and validation of suitable analytical methods for their extraction and determination in biological samples. Analytical techniques, able to detect PhACs at trace quantities in biota, have been developed in our lab for different biological matrices (fish, bivalves, macroinvertebrates and biofilm) and will be presented along with the results of some field studies in Spain and Argentina, where these compounds have been monitored.

Trends regarding the most prevalent compounds in different river basins, different trophic levels, and different species will be discussed. Levels found in aquatic biota were in general in the low ng/g range but occasionally reached values up to 229.8 ng/g of sertraline in biofilm, 93.7 of diclofenac in macroinvertebrates or 163 ng/g of codeine in fish. Diclofenac was overall the most prevalent compound as it was found in all type of biological matrix analyzed. Suquia River in Argentina, followed by Llobregat River in Spain was identified as the most polluted river according to the number and levels of pharmaceuticals in biota. Finally, biofilm is proposed as potential sentinel of exposure to pharmaceuticals in aquatic environment: they are able to retain the higher number of compounds and at higher concentrations than other organisms.

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Target and nontarget data analysis of trace emerging contaminants in environmental samples

Dr. Marko Rožman
Ruđer Bošković Institute - RBI, Division of Physical Chemistry, Zagreb, Croatia

In our modern, globalising world natural settings are rarely optimal and most freshwater environments experience simultaneous impact of vast number of anthropogenic contaminants. Both parent compounds and their transformation products can potentially accumulate in the environment and exert adverse effects. Improvements in extraction, enrichment, and analytical procedures mean that increasing numbers of chemicals can be detected in samples. Furthermore, the evolution of mass spectrometry coupled with liquid chromatography has opened up new windows of opportunity and it is now possible to monitor expected and unexpected compounds together.

Three major approaches for mass spectrometric data post-processing, depending indispensably on the instrumentation and available software, include: target analysis, suspect screening and nontarget analysis. The presentation will give a short overview of the systematic workflow for all three approaches and highlight their main characteristics and requirements.

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